

ANT COLONY OPTIMIZATION FOR SOFTWARE PROJECT SCHEDULING AND STAFFING WITH AN EVENT-BASED SCHEDULER

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Abstract:- Research into creating powerful machine helped systems for arranging programming activities is essential and testing for programming building. Unique in relation to ventures in different fields, programming activities are individuals serious exercises and their related assets are chiefly human assets. Hence, a sufficient model for programming task arranging needs to manage not just the issue of venture undertaking planning additionally the issue of human asset portion. Anyhow as both of these two issues are troublesome, existing models either experience the ill effects of a huge pursuit space or need to confine the adaptability of human asset distribution to disentangle the model. To create an adaptable and viable model for programming task arranging, this paper creates a novel methodology with an occasion based scheduler (EBS) and a burrowing little creature state improvement (ACO) calculation. The proposed methodology speaks to an arrangement by an assignment rundown and a arranged worker designation network. Thusly, both the issues of assignment booking and worker designation can be considered. In the EBS, the starting time of the undertaking, the time when assets are discharged from completed errands, and the time when workers join or leave the undertaking are viewed as occasions. The fundamental thought of the EBS is to modify the designation of workers at occasions and keep the assignment unaltered at non events. With this technique, the proposed system empowers the displaying of asset clash and errand acquisition and jelly the adaptability in human asset designation.

Keywords:- ACO-Ant Colony Optimization, SPP-Software Project Planner, RCPSP-Resource Constraint Project Scheduling Problem.

I. INTRODUCTION

WITH the quick improvement of the product business, programming organizations are currently confronting an exceptionally competitive business. To succeed, organizations need to make productive venture arrangements to lessen the expense of programming development. Be that as it may, in medium to vast scale ventures, the issue of undertaking arranging is extremely perplexing and testing. Indeed, in China it was accounted for that more than percent of unsuccessful programming tasks fizzled as a result of wasteful arranging of task errands and human assets. Because of the imperativeness and trouble of programming task arranging, there is a becoming requirement for creating compelling machine helped instruments for programming task arranging as of late. To arrange a product extend, the task administrator needs to gauge the venture workload and cost and choose the task calendar and asset allotment. For workload and fetched estimation, a few acclaimed models like COCOMO, have been created and generally utilized. For planning and staffing administration, comparably to different tasks (e.g., development ventures), administration is normally transmitted by task administration apparatuses and methods. Case in point, conventional undertaking administration procedures like the project assessment and survey procedure (PERT), the discriminating way strategy (CPM), and the asset obliged undertaking planning issue (RCPSP) model have been connected in programming undertaking arranging.

Despite the fact that these strategies are imperative and accommodating, they are progressively considered to be insufficient for demonstrating the interesting attributes of today's product ventures. The principle reason is that, uniquely in contrast to different undertakings, a product task is an individuals concentrated action and its connected assets are mostly human assets. Distinctive delicate product venture assignments oblige workers with diverse aptitudes, furthermore ability capability of workers fundamentally impacts the proficiency of undertaking execution. As being what is indicated, appointing representatives to the best-fitted errands is trying for programming venture chiefs, and human asset designation has turned into a urgent part in programming task arranging. Systems like PERT and CPM fail to offer the thought of asset assignment and planning models like

the RCPSP do not consider the assignment of workers with different aptitudes. Hence, the instruments focused around these customary task administration methods normally respect assignment planning also human asset portion as two divided exercises also leave the employment of human asset portion to be carried out by venture supervisors physically , bringing about wasteful asset distribution and poor administration execution. Besides, as the principle assets in programming improvement are people rather than huge machines, assets in programming ventures can typically be assigned in a more adaptable manner than those in development or assembling ventures. In contemporary programming ventures, it is regular that a developer joins numerous module advancement assignments all the while, furthermore it is likewise conceivable that he stops his current work and joins the other more basic errands .

In this paper, we create a handy and successful approach for the undertaking booking and human asset distribution issue in programming task arranging with a burrowing little creature state enhancement (ACO) calculation. Unique in relation to the existing methodologies, the proposed strategy is portrayed by the accompanying two peculiarities. In the first place, a representation plan with a novel occasion based scheduler (EBS) is created. The representation plan is made out of an assignment rundown and an arranged worker distribution network. The assignment rundown characterizes the needs of undertakings to devour assets, and the arranged worker distribution network defines the initially arranged workload assignments. Thusly, the representation takes both the issues of assignment planning and asset distribution into record. The EBS respects the starting time of the venture, the time at the point when assets are discharged from any completed undertaking, and the time when representatives join or leave the venture as occasions. To produce a real timetable, the EBS alters the workload assignments of representatives at occasions and asset clash is understood as per the need characterized by the errand list. In along these lines, the proposed plan is viable and adaptable as it empowers the displaying of errand appropriation and asset clash. In the meantime, contrasted and the d network representation , the proposed plan diminishes the measure of the hunt space and in this way quickens the inquiry process. In expansion, as the EBS just makes new assignments at occasions, it has the capacity keep the execution of undertakings in a more stable way.

II. LITERATURE SURVEY

As excessive schedule and budget compression becomes the norm in today's software industry, an understanding of the impact of schedule and budget pressures on software development performance is crucial for effective management strategies. This study introduced related behavioural perspectives to explore the mechanism of the pressure effect. Based on the mechanism, research models were developed to predict the effects of schedule and budget pressures on major dimensions of project performance: cycle time, effort and quality. The research models were empirically tested with data from a \$25 billion/year international IT (information technology) firm. We found that a U-shaped relationship existed between schedule pressure and cycle time. Similar relationships were seen between budget pressure and development time and effort. Budget pressure had a significant impact on software quality, whereas schedule pressure did not significantly affect software quality. The theoretical development and empirical findings of this study contribute to optimal budget and deadline setting policies in software development industry. They also help reconcile conflicting views from the literature.[1]

This paper addresses the trainees assignment problem of an IT service firm. A Linear Programming (LP) model is developed to assign trainees to projects as per the requirements, considering their skill set and location preferences. The resulting LP model is solved using the actual cost data from the firm. This paper also discusses the implications of human resource allocation policies on the total cost. Large IT service organizations face challenges in workforce planning and assignment owing to their size and scale. For instance, every year, thousands of trainees join such an IT firm. The planning and execution of trainee allocation is the major area of work for a trainees' resource manager (RM) of an IT firm. Each trainee is trained primarily in one technology stream in addition to the general training after joining. The quarterly projections of trainees' requirements for different projects are collected and are consolidated based on the location and technology stream by the RM. The RM has to then assign these thousands of trainees to multiple projects at various locations to meet the project requirements.[2]

Software development organizations often struggle to deliver projects on time, within budget and with the required quality. One possible cause of this problem is poor software project management and, in particular, inadequate project scheduling and ineffective team staffing. This paper investigates the application of a particle swarm optimization algorithm to help software project managers perform these activities effectively. Specifically, the proposed approach aims to create optimal project schedules by specifying the best sequence for executing a project's tasks and minimizing the total project duration. Simultaneously, it seeks to form skilful and productive working teams with the best utilization of developer skills. These considerations have been suitably encoded into the algorithm, with several hard constraints and objective functions appropriately formulated so as to assess the generated solutions with respect to their feasibility and also their quality. The initial results obtained are quite encouraging for the majority of the performed tests and indicate that the proposed approach is able to deal with the issues of scheduling and staffing in software project management.[4]

III. PURPOSE

A web based application which extracts and analyses the dataset

1. Solution construction—During each iteration of the algorithm, a group of ants set out to build solutions to the problem. Each ant builds a solution in a constructive manner by selecting components step by step to form a complete solution.
2. Pheromone management—Along with the solution construction procedure, pheromone values are updated according to the performance of the solutions built by ants.

3.1 Advantage

It provides a more flexible and efficient way for human resource allocation and its performance is improved.

IV. TECHNIQUE

We use technique for solve that both task scheduling and employee allocation matrix. ACO is used for schedule task and employee. The problem of SPSP is solved using ACO includes the important algorithm is ACS:SPSP algorithm and construction graph for selecting the dedication of each employee to the task and heuristic information is calculated by using one of the six strategies and designing the pheromone to solve the communication problem. Construction Graph- ACO is widely used to solve the combinatorial problem. The 1st step of applying ACO to SPSP is to construct graph that will assign the dedication of each employee to the task. Each employee gives some dedication to the task, so this can be assigned to the task by using construction graph. Construction graph is designed by splitting the task into number of nodes and this nodes depends upon the number of employee and the value if minimum dedication. First we calculate the density of nodes.

$$\text{Density} = \text{minded} - 1 + 1;$$

Where, minded is minimum dedication of employee to task j. The value of dedication is start from 0 and it is increased in multiple of minded. The value of density is 5 when the value of minded is 0.25. the split operation of a task in TPG is described as follows:

1. Select starting node and put into column 0
2. According to the number of employee, create E number of column and give names as column1 to Column E, each column include Density number of nodes.
3. Identify end node and add to the ColumnE+1
4. Construct all possible edges from column i to columni+1.

After splitting the task ant select one by one edge and reaches to the next task. This path is straight forward. The Construction Graph is shown in Figure. There is no any returning backward path. Ant select edge according to the dedication of employee to the task. Ant selects only one edge from each column and goes to next column. At the end when ant reaches to the end of node i.e. end task that time the total task is assigned to employee and one tour is complete. After that according to the dedication of employee the quality of solution is evaluated.

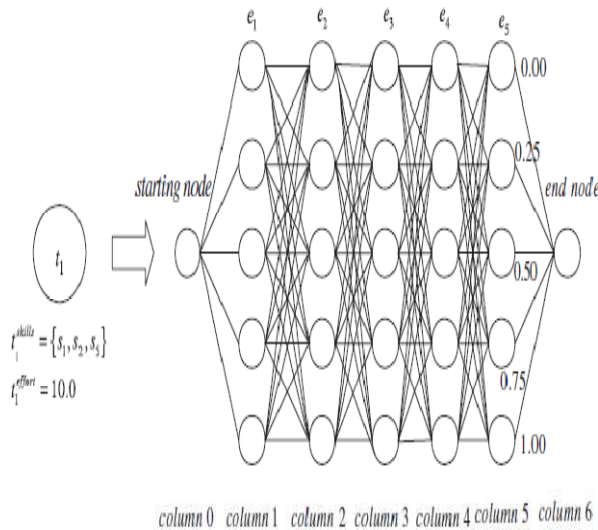


Fig 3.1: Construction Graph

Implementation of ACS-SPSP: We have constructed the graph that will help to assign the dedication of employee to the task. Once the tour is completed the quality of solution is checked by using fitness function ACS is employed to obtain the best solution which has the maximum fitness values. The fitness function is defined as the inverse weighted sum of project cost and project duration. We consider the importance of project cost and duration is equal in the fitness function and the weights are used to adjust the project cost and duration to the same order of magnitude. The fitness function is presented as following:

The details of ACS-SPSP are as follows:

1. Initialize all parameter that are used in ACO. Such as ,Q0,p ,Ngen , Nant.are used to evaluate the importance of history information and heuristic information. Which adjust the pheromone updating, ?0 balance the exploration and exploitation behaviour, Ngen is the number of generation of ACO , Nant is the number of ant.
2. Initialize pheromone values. All values are 0.
3. Ant select path to get solution. Each ant select next node in construction graph using selection scheme. Each ant maintains its own solution matrix and stores the result dedication values into that matrix.
4. Evaluate the quality of a matrix using fitness function. Calculate the cost and duration of project as well as over time load of the employee.
5. Select the best solution and update the pheromone values using pheromone update formula.
6. Step 3-5 repeat till the termination condition is not satisfied. Termination condition is either the number of generation or the quality of solution.
7. Select the best solution whose cost and duration is less according to the fitness function.

4.1 Pheromone management

Ant select path in construction graph using selection scheme and when tour is finished that means all task are successfully assigned to the employee, by using fitness function we check the quality of solution and if solution is best then the pheromone values are updated. Pheromone values are updated in two times. The update of pheromone t_{ij} on the edge ended with N_{ij} is implemented by the following equation: Where , p is the $0 < p < 1$, τ is a factor which indicate show much influence old pheromone makes on new pheromone and is an offset related to the quality of current solution. If τ is large, the new pheromone value is less affected by old pheromone value but much affected by and vice versa.

In local pheromone updating scheme, only the duration and cost of a single task are used. The offset in global pheromone updating rule is given by: Where The offset in local pheromone updating rule is given by: $t(i,j)$ is the pheromone on the path ended with node N_{ij} and $t(i,j)$ is the heuristic information of the problem. a and b are both fixed parameters.

4.2 Heuristic information

Ant select next node in construction graph when task is split, using the heuristic information and selection scheme. This paper use six different heuristic strategies to calculate heuristic information. Out of those Allocated Dedication is the best strategy and whose result is best than the other strategies. The basic formula used for calculating the heuristic information is as, Where, TOTAL is the sum of all temporary values as calculated as $Total = \sum_{i=0}^n Temp[i]$, Density AD strategy means that the heuristic information is related to the dedication of employee e_i has already been contribute to other task.

V. DESIGN DOCUMENTS

5.1 Use Case Diagram

The use case diagram of task and employee allocation is shown below. In use case diagram actor and activity is included. Here actor is project manager that will visualise a project scheduling. It includes number of operation. All these related activity of Project manager and planner is shown in use case diagram. The detail description and separate use case diagram for visualise schedule are as follows. The planner is a system. It is also an actor.

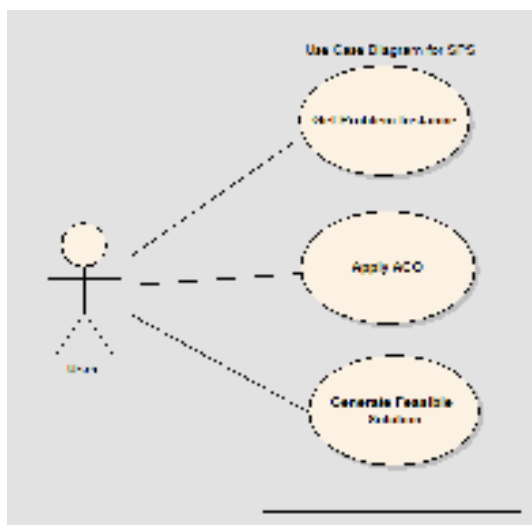


Fig 5.1: Use Case Diagram of SPS

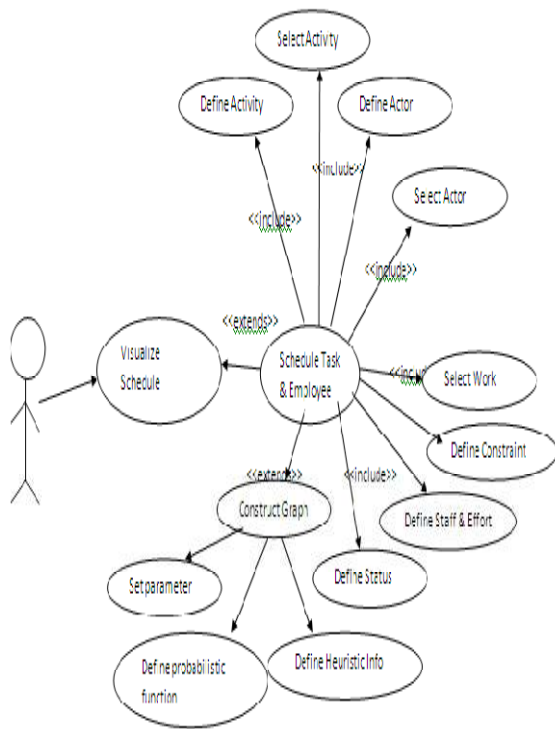


Fig 5.2: Use Case Diagram For task scheduling

5.2 Class Diagram

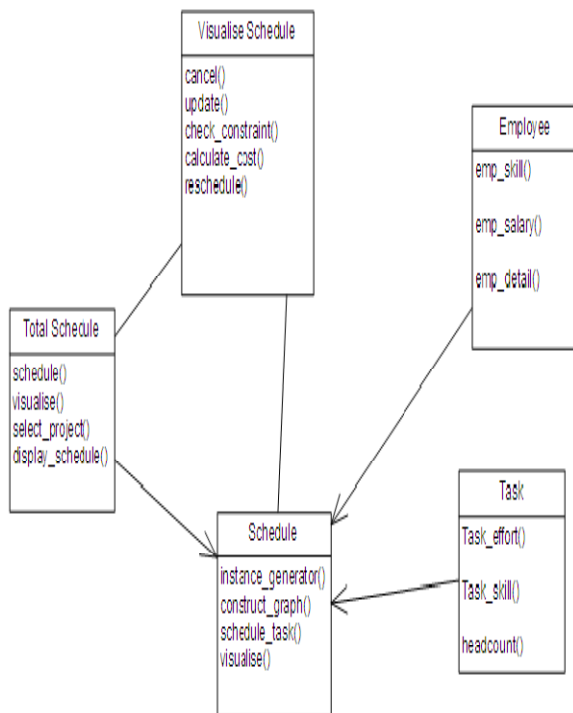


Fig5.3: Class diagram of the Task Scheduling

VI. CONCLUSION

A new method for solving the software project planning problem has been developed. The main characteristics of the proposed method are in two aspects. First, the method introduces an event-based scheduler. Second, the method takes advantage of ACO to solve the complicated planning problem. Experimental results show that the representation scheme with the EBS is effective, and the proposed algorithm manages to yield better plans with lower costs and more stable workload assignments compared with other existing approaches.

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